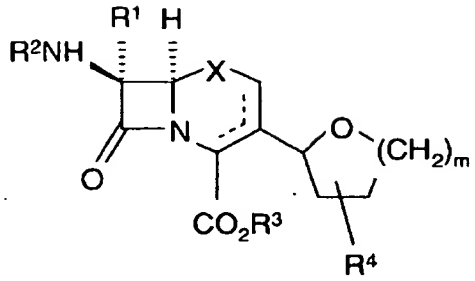
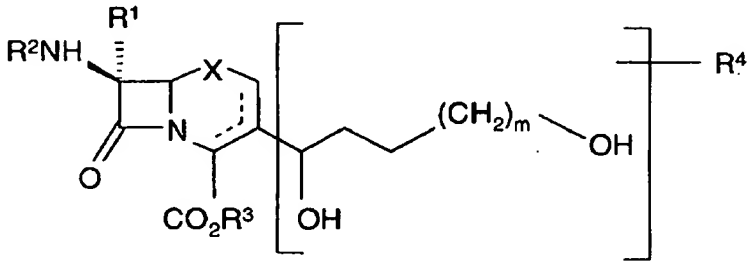
Listing of Claims

Claim 1. (Currently Amended) A process for the preparation of a compound of formula (II):



(II)

[[which includes the step of]] comprising cyclising a compound of formula (III):



(III)

wherein in formulae (II) and (III), R^1 is hydrogen, methoxy or formamido;

_____R^2 is an acyl group;

_____[[CO_2R^3 is a carboxy group or a carboxylate anion, or R^3 is a readily removable carboxy protecting group]]R^3 is hydrogen or an ester-forming carboxyl-protecting group which may be removed under conventional conditions, or an *in vivo* hydrolysable ester radical;

_____R^4 represents hydrogen or up to four substituents independently selected from alkyl, alkenyl, alkynyl, alkoxy, hydroxy, halogen, amino, alkylamino, acylamino, dialkylamino, CO_2R, $CONR_2$, SO_2NR_2 (where R is hydrogen or C_{1-6} alkyl), aryl and heterocyclyl[[, which may be the same or different]], where in formula (III) the substituent(s) when other than hydrogen may replace any of the hydrogen atoms bonded to carbon atoms in the side chain;

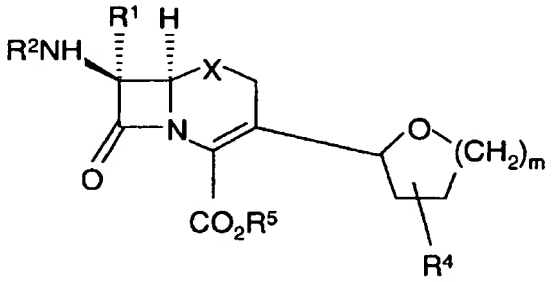
_____X is S, SO, SO_2, O, or CH_2; [[and]]

_____m is 1 or 2; and

_____the dotted line indicates [[that the compounds (II) and (III) may be a 2-cephem or a 3-cephem system,]]a double bond between C2 and C3 or between C3 and C4 of formula (II).

[[and where in formula (III) the $\underline{R^4}$ substituent(s) [[R^4]] when other than hydrogen may replace any of the hydrogen atoms bonded to carbon atoms in the side chain.]]

Claim 2. (Currently Amended) [[A]] The process according to claim 1 wherein the compound of formula (II) is a [[3-cephem]] compound of formula (IIA) where the double bond is between the C3 and C4 carbons of formula (II) or a pharmaceutically acceptable salt or pharmaceutically acceptable *in vivo* hydrolysable ester thereof:



(IIA)

[[wherein R^1, R^2, R^4, m and X are as defined with respect to formula (II)]]

wherein in formulae (II) and (III), R^1 is hydrogen, methoxy or formamido;

R^2 is an acyl group;

R^4 represents hydrogen or up to four substituents independently selected from alkyl, alkenyl, alkynyl, alkoxy, hydroxy, halogen, amino, alkylamino, acylamino, dialkylamino, CO_2R, $CONR_2$, SO_2NR_2 (where R is hydrogen or C_{1-6} alkyl), aryl and heterocyclyl;

X is S, SO, SO_2, O, or CH_2;

m is 1 or 2; and

the dotted line indicates a double bond between C2 and C3 or between C3 and C4 of formula (II); and [[the group]]

CO_2R^5 is CO_2R^3 where [[CO_2R^3 is a carboxy group, or a carboxylate anion]] R^3 is hydrogen or an ester-forming carboxyl-protecting group which may be removed under conventional conditions, or an *in vivo* hydrolysable ester radical.

Claim 3. (Currently Amended) [[A]] The process according to claim 1 or 2 wherein X is S, O, or CH_2.

Claim 4. (Currently Amended) [[A]] The process according to claim[[s]] 1, or 2

[[or 3]] wherein the cyclic ether at the 3-position of the cephalosporin nucleus in formulae (II) and (IIA) is unsubstituted.

Claim 5. (Currently Amended) [[A]] The process according to [[any one of]] claim[[s]] 1 [[to 4]] or 2 wherein m is 1, so that the cyclic ether at the 3-position in formulae (II) and (IIA) is a tetrahydrofuranyl system.

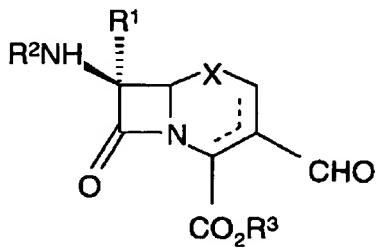
Claim 6. (Currently Amended) [[A]] The process according to claim 5 wherein the cyclic ether at the 3-position in formulae (II) and (IIA) is an (S)-tetrahydrofuran-2-yl ring system.

Claim 7. (Currently Amended) [[A]] The process according to [[any one of the preceding]] claim[[s]] 1 or 2 wherein in formula (III) when m is 1 the 1, 4-dihydroxylbut-1-yl side chain is the less polar diastereoisomeric form.

Claim 8. (Currently Amended) [[A]] The process according to [[any one of the preceding]] claim[[s]] 1 or 2 wherein the cyclisation reaction of the process of the invention is carried out by treatment of the compounds (III) with an acid catalyst.

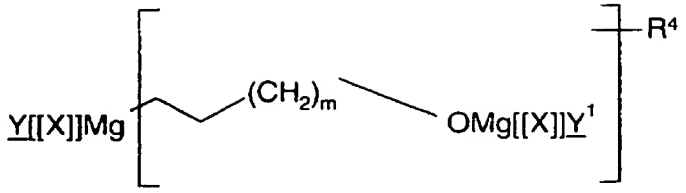
Claim 9. (Currently Amended) [[A]] The process according to [[any one of]] claim[[s]] 1 [[to 7]] or 2 wherein the cyclisation reaction is carried out by treatment of the compounds (III) with an acylating agent.

Claim 10. (Currently Amended) [[A]] The process according to [[any one of the preceding]] claim[[s]] 1 or 2, wherein the compound of formula (III) is prepared by reacting a compound of formula (IV):



(IV)

with a compound of formula (V):



(V)

[[where R^4 and m are as defined with respect to formula (III), and X and X^1]]

wherein R^1 is hydrogen, methoxy or formamido;

R^2 is an amino-protecting group;

R^3 is an ester-forming carboxyl-protecting group which may be removed under conventional conditions;

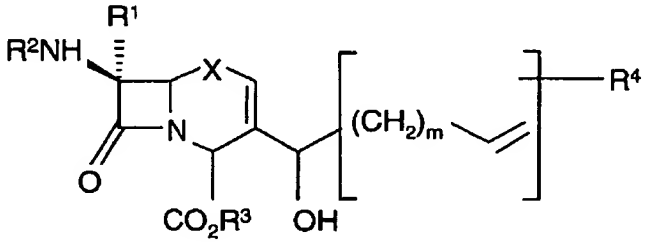
R^4 represents hydrogen or up to four substituents independently selected from alkyl, alkenyl, alkynyl, alkoxy, hydroxy, halogen, amino, alkylamino, acylamino, dialkylamino, CO_2R, $CONR_2$, SO_2NR_2 (where R is hydrogen or C_{1-6} alkyl), aryl and heterocyclyl;

m is 1 or 2;

Y and Y^1 are the same or different halogen, and

the dotted line in formula (IV) indicates a double bond between C2 and C3 or between C3 and C4 of formula (IV).

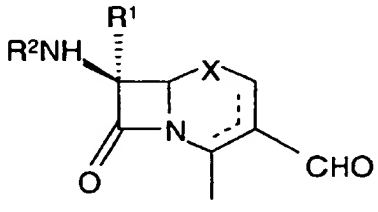
Claim 11. (Currently Amended) [[A]] The process according to [[any one of]] claim[[s]] 1 [[to 10]] or 2, wherein the compound of formula III is prepared [[by converting a compound of formula (IV) [[(as defined in claim 10) into]] from a compound of formula (VIII):



(VIII)

wherein said compound of formula VIII is then hydroxylated to form a compound of formula III; [[where R^1, R^2, R^3, R^4, m, and X are as defined with respect to formula (III).]]

wherein the compound of formula (VIII) is prepared from a compound of formula (IV):



(IV)

wherein R^1 is hydrogen, methoxy or formamido;

R^2 is an amino-protecting group;

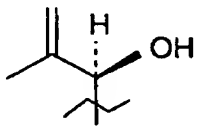
R^3 is an ester-forming carboxyl-protecting group which may be removed under conventional conditions;

R^4 represents hydrogen or up to four substituents independently selected from alkyl, alkenyl, alkynyl, alkoxy, hydroxy, halogen, amino, alkylamino, acylamino, dialkylamino, CO_2R, $CONR_2$, SO_2NR_2 (where R is hydrogen or C_{1-6} alkyl), aryl and heterocyclyl;

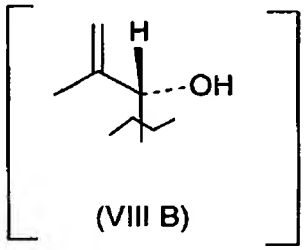
m is 1 or 2; and

the dotted line in formula (IV) indicates a double bond between C2 and C3 or between C3 and C4 of formula (IV).

Claim 12. (Currently Amended) [[A]] The process according to claim 11 wherein the compound of formula (VIII) has a hydroxyl group configuration (VIII A):



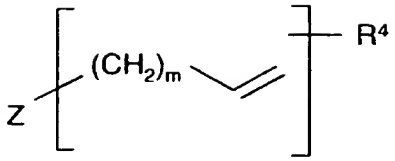
(VIII A)



(VIII B)

Claim 13. (Currently Amended) A process according to claim [[11 or]] 12 wherein the compound of formula (IV) is formed into a compound of formula (VIII) by reaction with an organometallic reagent.

Claim 14. (Currently Amended) [[A]] The process according to claim 13 wherein the organometallic reagent is a compound of formula (IX):



(IX)

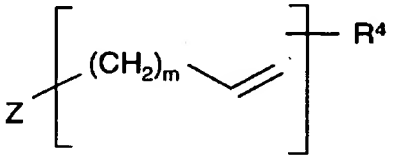
[[where m and R^4 are as defined in formula (VIII), and]]

wherein R^4 represents hydrogen or up to four substituents independently selected from alkyl, alkenyl, alkynyl, alkoxy, hydroxy, halogen, amino, alkylamino, acylamino, dialkylamino, CO_2R, $CONR_2$, SO_2NR_2 (where R is hydrogen or C_{1-6} alkyl), aryl and heterocyclyl;

m is 1 or 2; and

Z is [[Y]]Z'Mg where [[Y]]Z' is a halogen.

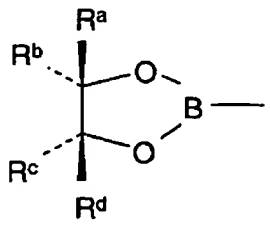
Claim 15. (Currently Amended) [[A]] The process according to claim 11 or 12 wherein the compound of formula (VIII) is prepared stereospecifically from a compound of formula (IV) by the use of a compound (IX):



(IX)

in which Z is a chirally inducing group which leads to preferential formation of a desired configuration of the hydroxyl group in the compound (VIII).

Claim 16. (Currently Amended) [[A]] The process according to claim 15 wherein Z is the boronate group (X):

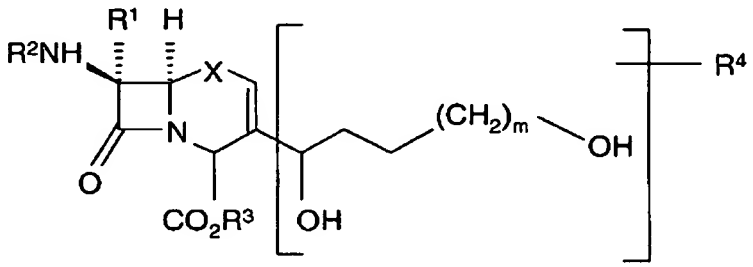


(X)

where R^a, R^b, R^c, and R^d are independently selected from hydrogen, alkyl and protected carboxy.

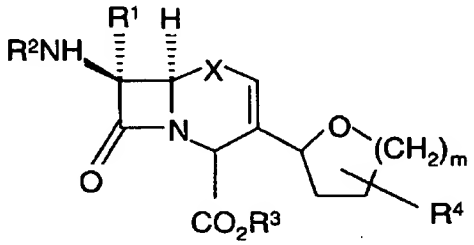
Claim 17. (Currently Amended) [[A]] The process according to claim 16 wherein group (X) is [[a pinacol boronate group or]] a tartrate boronate group wherein R^a is alkylcarboxylate, R^b is hydrogen, R^c is alkylcarboxylate and R^d is hydrogen.

Claim 18. (Currently Amended) [[A]] The process according to [[any one of]] claim[[s]] 10 [[to 17]] wherein the compound (IV) is [[converted into a 2-cephem]] alkylated with a compound of formula (V) to form a compound of formula (III), which is then hydroxylated to form a compound of formula (III A):



(III A)

which is [[converted during the cyclisation process of the invention into a 2-cephem]] then cyclized to form a compound of formula (II B):



(II B)

[[where R^1, R^2, R^3, R^4, X and m are as defined in formulae (II) and (III) above, and the 2-cephem]] and the compound of formula (IIB) is then converted into a [[3-cephem]] a compound formulae (II);

wherein R^1 is hydrogen, methoxy or formamido;

R^2 is an acyl group;

R^3 is hydrogen or an ester-forming carboxyl-protecting group which may be removed under conventional conditions, or an *in vivo* hydrolysable ester radical;

R^4 represents hydrogen or up to four substituents independently selected from alkyl, alkenyl, alkynyl, alkoxy, hydroxy, halogen, amino, alkylamino, acylamino, dialkylamino, CO_2R, $CONR_2$, SO_2NR_2 (where R is hydrogen or C_{1-6} alkyl), aryl and heterocyclyl, where in formula (III) the substituent(s) when other than hydrogen may replace any of the hydrogen atoms bonded to carbon atoms in the side chain;

X is S, SO, SO_2, O, or CH_2;

m is 1 or 2; and

the dotted line indicates a double bond between C2 and C3 or between C3 and C4 of formula (II).

Claim 19. (Withdrawn) A process according to any one of the preceding claims, substantially as hereinbefore described, with reference to the accompanying examples.

Claim 20. (Withdrawn) The product of a process according to any one of claims 1 to 19.

Claim 21. Delete

Claim 22. (New) The process according to claim 1 where the ester-forming carboxyl-protecting group of R^3 is benzyl, p-methoxybenzyl, benzoylmethyl, p-nitrobenzyl, 4-pyridylmethyl, 222,trichloroethyl, 2,2,2-tribromoethyl, *t*-butyl, *t*-amyl, allyl, diphenylmethyl, triphenylmethyl, adamantyl, 2-benzyloxyphenyl, 4-methylthiophenyl, tetrahydrofur-2-yl, tetrahydropyran-2-yl, pentachlorophenyl, acetonyl, *p*-toluenesulphonylethyl, methoxymethyl, or an oxime radical of formula $-N=CHR^7$ where R^7 is aryl or heterocyclic.

Claim 23. (New) The process according to claim 1 where the *in vivo* hydrolysable ester group of R^3 is acetoxymethyl, pivaloyloxymethyl, α-acetoxyethyl, α-pivaloyloxyethyl, 1-(cyclohexylcarbonyloxy)prop-1-yl, (1-aminoethyl)carbonyloxymethyl, ethoxycarbonuloxymethul, α-ethoxycarbonyuloxyethyl, propoxycarbonyloxyethyl, dimethylaminomethyl, dimethylaminoethyl, diethylaminomethyl, diethylaminoethyl, 2-(isobutoxycarbonyl)pent-2-enyl, 2-(ethoxycarbonyl)but-2-enyl, phthalidyl, and dimethoxyphthalidyl.